Measuring Progress Towards Equitable Child Survival

Where are the Epidemiologists?

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Abstract: The fourth Millennium Development Goal (MDG) is to achieve a two-thirds reduction in the mortality of under the age of 5 years children between 1990 and 2015. Only 7 of the 60 priority countries are currently on track towards the goal, and intensified efforts are required both globally and nationally. Tackling inequities is essential for reaching this goal, because children from poor families are consistently at higher risk of dying. Efforts should be concentrated on achieving high and equitable coverage with low-cost, effective, off-the-shelf interventions, and on monitoring progress among different social groups. Measuring inequities in mortality, morbidity, nutritional status, and coverage, however, is fraught with methodologic difficulties in countries where routine statistics are unreliable—a group that includes all high-mortality countries. Key methodologic challenges are discussed, with arguments for greater involvement of epidemiologists in measurement exercise that so far has been led by demographers, statisticians, and economists.

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The most striking aspect of global epidemiology is the massive gap in morbidity and mortality between rich and poor populations. Take for example the mortality of children under 5 years of age. Three of every thousand children born in Iceland will die before their fifth birthday, compared with an estimated 250–300 in Afghanistan, Angola, Niger, and Sierra Leone.1 Worse still, the mortality ratio between levels in poor and rich countries is increasing: between 1970 and 2000, under-five mortality fell by 40% in poor countries and by 71% in high-income countries.2 Child deaths in rich countries are due to causes that are much harder to tackle than those prevalent in poor countries, yet rich countries show faster progress in reducing mortality.

In 2000, global leaders from 192 countries pledged to achieve 8 Millennium Development Goals, or MDGs. The fourth goal addresses child survival: to reduce by two-thirds mortality rates among under-five children, between 1990 and 2015. It might appear odd that a goal set in 1999 would set a baseline 10 years earlier, but this is among the measurement issues that we will attend to below.

The MDGs have been criticized as being a top-down initiative pushed upon countries and communities by the United Nations and other international institutions. Even so, there is no doubt that their endorsement by most of the world’s leaders has brought into the mainstream issues related to global development, including health, education, gender equity, and poverty reduction.

Seven years after the Millennium Goals were set up, much has been learned about child survival. We know that two-thirds of the over 10 million annual under-five deaths3,4 could be avoided by making low-cost, low-tech interventions available to all children in the world. These include breastfeeding promotion, micronutrient supplementation, safe delivery practices, vaccines, insecticide-treated mosquito nets, and simple treatments for diarrhea, pneumonia, sepsis, and malaria dispensed by community health workers. We also know, however, that only 7 among 60 priority countries are currently on target to reach the MDG for child mortality reduction.5

Just as there are massive and growing inequities in under-five mortality between rich and poor countries, within-country socioeconomic inequities are also large. A recent compilation of Demographic and Health Surveys in 56 countries6 showed that, for every country studied, children whose families belong to the highest quintile of wealth have mortality rates substantially lower than children in the poorest quintile. Even within apparently homogeneous populations, socioeconomic inequities are prominent. We carried out a survey in rural Tanzania and found that 36% of children in the top quintile of wealth had received an antibiotic for a recent pneumonia episode, while not a single child in the poorest quintile received these drugs.7

Some might argue that equity considerations are irrelevant for reaching the Millennium Goals. Mathematical simulations show that high-mortality countries may achieve a two-thirds overall reduction by intervening primarily on the better off.8 Because the rich tend to adopt new interventions earlier than the poor, inequities often increase as new health technologies are introduced.9 A rapid push to achieve the Millennium Goals may therefore widen the equity gap.

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ever, there are ethical and practical reasons for promoting equity while pushing for a rapid overall reduction. The ethical reasons speak for themselves. The practical reasons are related to the scope for improvement being much greater among the poor than among the better off. Although it may be costly to reach the poorest—who often live in more remote areas with limited access to health facilities—the potential payoff is also greater given their higher baseline mortality and lower intervention coverage levels.

Monitoring progress towards the MDGs in low-income countries—both for the population as a whole and for different socioeconomic strata—is a complex task. The first challenge is related to data availability. A Brazilian epidemiologist was once asked in an international congress whether he had any statistics on snakebite injuries. He replied, “We have a problem in my country. Where there are snakes there are no statistics, and where there are statistics there are no snakes.” This is not unlike the situation for child mortality—areas with high deaths rates seldom have reliable data. My own training was as an academic epidemiologist who must have tight control of data collection in cohort, case-control, and intervention studies. Becoming involved in large-scale countrywide surveys introduced me to a new set of challenges. Two major survey initiatives—the Demographic and Health Surveys (DHS) and Multiple Indicator Cluster Surveys (MICS)—were launched as a result of a massive international effort started in the 1990s. Both provide invaluable information on maternal and child health and nutrition, intervention coverage, and mortality. Over the past 5 years or so, DHS has been carried out in over 50 countries and MICS in about 60 countries. There is little geographic overlap between the surveys, so that approximately 100 countries have been covered. Their questionnaires are not identical but are highly compatible, resulting in similarly defined indicators that allow cross-country comparisons.

These surveys tend to be expensive at face value. DHS reportedly costs over a million dollars to administer and MICS between US $300,000 and $400,000. Costs vary according to several factors, mainly the number of subnational areas for which separate estimates are required. Given the amount of information provided by these surveys, I think they are a good buy. Due to their cost, however, the surveys tend to be carried out infrequently, typically about every 5 years in a given country. UNICEF is now committed to increase the frequency of MICS to every 3 years. Greater frequency of surveys is essential for monitoring progress in the next 8 years, leading to the final assessment of whether the MDGs are reached.

These surveys are far from immune to methodologic problems. Their questionnaires were developed initially in English, and later translated to the main national language in each country (and back-translated). For example, a Portuguese translation was used in Mozambique, but over 40 languages are spoken in the country and many mothers speak only their tribal language. Surveys thus depend on local interpreters who help the trained interviewers—a potential source of error when minor differences in wording may make a large difference in the answers obtained. Age ascertainment is also complex in rural illiterate societies—interviewers often use a calendar of major events (presidential elections, droughts or floods, seasons, etc) to attempt to estimate a child’s age.

PROBLEMS OF MEASUREMENT

Measuring Wealth

Monitoring inequities requires assessing socioeconomic status. In studies from high- and middle-income countries, this is often ascertained through proxies such as schooling, income or occupation, but in poor countries these indicators are often unreliable or too homogeneous. A novel approach is to collect data on household characteristics and assets (eg, type of floor; sanitation facilities; number of rooms; ownership of radio, bicycle, etc) and run principal component analyses, selecting the first component as a general indicator of wealth. This may then be divided into groups, usually quintiles. Such asset indices are not devoid of problems—for example, the choice of assets can result in changes in the classification of families, but there is no doubt that their wide adoption by survey designers has opened many possibilities for understanding inequities in child health and ways to tackle them.

Measuring Coverage of Preventive Interventions

Reaching high and equitable population coverage with cost-effective interventions is crucial for achieving the fourth MDG. Coverage measurement is apparently straightforward. One needs to select a probability sample of the target population through a survey such as DHS or MICS, identify the mothers or children who constitute the denominator for...
the coverage indicator and obtain the relevant information. Key coverage indicators have been agreed upon by international institutions such as the World Health Organization and UNICEF. and include all evidence-based interventions. The denominators for some of the key indicators (eg, percentage of children aged less than 6 months who are exclusively breast-fed) are rather small, so that sampling error can be large. For other indicators (eg, percent of children age 6–59 months who received a vitamin A capsule in the last 6 months), obtaining precise information from mothers with low schooling levels can prove difficult—mothers may be unable to distinguish different types of medicines received by the child. For other indicators (percent of children with access to safe water, for example), definitions may vary from country to country, making international comparisons tricky. Despite these problems, coverage measurement through population-based surveys provides remarkably useful data for monitoring and evaluation purposes. In low-income countries, coverage levels are consistently low, highlighting the need for renewed efforts.

Measuring Coverage of Curative Interventions

Assessing morbidity from routine statistics is a fiction in low-income populations. As few as 10% of sick children attend government health facilities in some countries, and even for those who attend, information systems are notably weak. Child health surveys typically inquire about disease episodes in the 2 weeks before the interview, usually for diarrhea, respiratory infections, and fever (as a proxy for malaria in endemic areas). Because of seasonality, these data cannot be used on their own for estimating annual disease burden. The main purpose of morbidity data is to provide the denominator for estimating coverage of curative interventions—oral rehydration for diarrhea, antibiotics for probable pneumonia, or antimalarials for fever. The 2-week recall period may be excessively long for accurate reporting of common conditions in high-morbidity populations, but it represents a compromise because use of shorter recall periods would result in small numbers of ill children, and consequently lead to less precise treatment coverage indicators. A special problem that affects the estimation of trends in coverage of curative interventions is that definitions and recommended treatments change over time. For example, there have been repeated changes in what constitutes oral rehydration therapy.

Measuring Nutritional Status

The first MDG—eliminating hunger—has as an indicator the proportion of children who are underweight, defined as weight-for-age less than 2 Z-scores below an international standard. DHS and MICS routinely measure weight and length (for children under 2 years) or height (for older children). Because of the nutrition transition taking place in many countries—particularly those in the middle-income group—using underweight as the key indicator is problematic. A child may be both short and fat, and would be classified as having a normal weight for age. Stunting, or the proportion of children with low length or height for age, is undoubtedly a better overall nutritional indicator than underweight, yet the latter has been chosen to monitor the Millennium Goal. Both stunting and underweight are point prevalence measures that refer to the day on which the child was examined. This gives them an advantage over the measure of mortality, which is back-dated as discussed below.

Measuring Mortality

The fourth MDG itself is expressed in terms of mortality reduction. Yet, mortality is harder to measure in a timely fashion than any of the previous indicators. Because death registration is reliable in only 72 of the world’s over 190 countries, data from surveys such as DHS and MICS are necessary to estimate mortality in low-income countries. Women of reproductive age are asked about their full birth histories—the month and year of birth for each of their children, whether each child is still alive and, if not, its age at death. With this information, mortality levels can be estimated retrospectively. Because deaths tend to be relatively rare events—except for very high mortality countries—precise estimation requires deaths to be pooled for the last 5 years before the survey. For a survey carried out in mid 2007, for example, deaths since mid 2002 would be included in the most recent estimate, with a midpoint at the end of 2004. Preliminary reports are typically available about 6 months after the survey is completed, so that by the end of 2007, one would obtain mortality rates for a point in time 3 years before. Time trends are assessed by comparing these mortality rates to those estimated for 5–9 and 10–14 years before the survey, all based on birth histories. (Rates for periods more than 15 years after the survey are deemed unreliable). Because policy makers and funders are keen to have up-to-date information, data from these estimates are then projected to the present. This leads, however, on a high degree of uncertainty. For example, reductions in the 2 years preceding the survey will be only partially detected by these projected rates.

The situation becomes even more complicated when policymakers demand (as is their right) subnational breakdowns to compare regions of their countries. Equity analyses also require dividing the sample into wealth quintiles. To obtain precise estimates for such subsamples (either regions or wealth quintiles) deaths occurring in the 10 years before the survey are usually pooled, with the resulting midperiod estimate being back-dated to 5 years before the survey.

International statistical compilations, such as UNICEF’s State of the World’s Children report or the World Health Statistics report rely heavily on projected statistics. For example, data published in 2005 global reports refer on average to mortality levels estimated for 1999, or even worse, for 1997 in high
mortality countries where fewer data points are available.\textsuperscript{20} This problem has been referred to as “statistical arthritis.”\textsuperscript{23}

Other sources of measurement error may affect mortality estimates. These include difficulties in ascertaining date of birth and age of death—particularly age hearing—and misclassification between stillbirths and early neonatal deaths. Because information on child deaths is obtained from living mothers, orphans are excluded and rates may be affected in areas with high adult female mortality due, for example, to HIV/AIDS or maternal deaths. Simulation exercises, however, suggest that the likely bias is not large, on the order of 5–7\% at most.\textsuperscript{24}

Finally, although sampling errors for the estimates are available in appendices to survey reports, the mortality rates themselves are presented as point estimates both in the original reports and in compilations, despite their considerable variability.\textsuperscript{25}

CONCLUSIONS

This long list of potential limitations of existing methods for monitoring and evaluating progress towards the fourth MDG should not detract from the fact that we have more data now than ever before on the health of children in poor societies. Despite imperfect measurement of socioeconomic position and of health outcomes, striking equity gaps are demonstrated over and over whether in terms of nutritional status, intervention coverage or mortality.\textsuperscript{3,6} The measurement tools reviewed here help to show which interventions are reaching the poor and which are not,\textsuperscript{26} to assess progress for various social groups, and to contribute to equity-sensitive monitoring and planning.\textsuperscript{27} Because most of the misclassification resulting from the use of current tools seems to be nondifferential, true levels of inequity are probably much larger than those we can detect using our crude methods.

I have visited more than 40 countries to help implement and evaluate child health programs and monitor progress in child health. I am struck by how few epidemiologists are involved in these activities. In most countries, national surveys are primarily carried out and analyzed by demographers, statisticians, and economists. Globally, research on inequalities in health is often led by these professionals. While disciplinary boundaries are somewhat blurred these days, I argue that the epidemiologic community should become more actively engaged in the study of child health in general, and of inequalities in particular. Many of the measurement challenges described here would markedly benefit from close involvement of epidemiologists at country and global level.

ABOUT THE AUTHOR

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REFERENCES